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Revision of European Elachistidae. The genus *Biselachista* Traugott-Olsen & Nielsen, 1977, stat. rev. (Lepidoptera: Elachistidae)

U. Parenti (†) & F. Pizzolato

Abstract

The genus *Biselachista* Traugott-Olsen & Nielsen, 1977, with a Holarctic diffusion and represented in Europe by seventeen species living in various environments, from sea level to 2000 metres in the Alps, is considered a valid genus. The biology of some species is well known thanks to laboratory rearings. Their host plants and parasites are reported. The pre-imaginal stages and the male and female genitalia are illustrated. The currently ascertained distribution is given. The examination of the type material permitted to ascertain the following synonymies: *Biselachista occidentalis* (Frey, 1882) is a synonym of *Biselachista juliensis* (Frey, 1870); *Elachista saarelai* Kaila & Sippola, 2010 is a synonym of *Biselachista kebneella* Traugott-Olsen & Nielsen, 1977.

KEY WORDS: Lepidoptera, Elachistidae, *Biselachista*, biology, genitalia, distribution, Europe.

Revision de Elachistidae europeos. El género *Biselachista* Traugott-Olsen & Nielsen, 1977, stat. rev. (Lepidoptera: Elachistidae)

Resumen

El género *Biselachista* Traugott-Olsen & Nielsen, 1977, con una diffusion Holártica y representado en Europa por diecisiete especies viviendo en diversos ambientes, desde el nivel del mar hasta los 2000 metros en los Alpes, es considerado un género válido. La biología de algunas especies es bien conocida gracias a las observaciones en el laboratorio. Se indican sus plantas nutricias y parásitos. Se ilustran los estados preimaginales y la genitalia del macho y de la hembra. Se da la distribución actualmente conocida. El examen del material tipo permite asegurar las siguientes sinonimias: *Biselachista occidentalis* (Frey, 1882) es una sinonimia de *Biselachista juliensis* (Frey, 1870); *Elachista saarelai* Kaila & Sippola, 2010 es una sinonimia de *Biselachista kebneella* Traugott-Olsen & Nielsen, 1977.

PALABRAS CLAVE: Lepidoptera, Elachistidae, *Biselachista*, biología, genitalia, distribución, Europa.

Revisione di Elachistidae europeo. Il genere *Biselachista* Traugott-Olsen & Nielsen, 1977, stat. rev. (Lepidoptera: Elachistidae)

Riassunto

Il genere *Biselachista* Traugott-Olsen & Nielsen, 1977, a diffusione oloartica e rappresentato in Europa da diciassette specie presenti nei più diversi ambienti, dal livello del mare ai 2000 metri della catena alpina, viene considerato un genere valido. La biologia di alcune specie è ben conosciuta grazie anche agli allevamenti in laboratorio. Sono segnalate le piante ospiti ed i parassiti. Vengono figurati stadi preimmaginali, gli adulti, i genitali maschili e femminili. È segnalata la distribuzione attualmente accertata. L'esame di materiale tipico ha permesso di accertare le seguenti sinonimie: *Biselachista occidentalis* (Frey, 1882) è sinonimo di *Biselachista juliensis* (Frey,

1870); *Elachista saarelai* Kaila & Sippola, 2010 è sinonimo di *Biselachista kebneella* Traugott-Olsen & Nielsen, 1977.

PAROLE CHIAVE: Lepidoptera, Elachistidae, *Biselachista*, biologia, genitali, distribuzione, Europa.

Introduction

The family Elachistidae is represented by small-sized moths with a particular biology. The larvae are, in fact, leafminers of mono- and dicotyledons. Polyphagy seems to be a rule (PARENTI & VARALDA, 1994).

In this paper we examine the genus *Biselachista*, represented in Europe by seventeen species. According to TRAUGOTT-OLSEN & NIELSEN (1977) the members of this genus, that they created, are characterized above all by the presence in the male genitalia of a gnathos divided into two small oval lobes.

KAILA (1999) considers *Biselachista* Traugott-Olsen & Nielsen, 1977 a synonym of *Elachista* Treitschke, 1833. But, apart from the gnathos, the species of the genus *Biselachista* differ remarkably from other Elachistids in different characters involving both the male and female genitalia.

Materials and methods

The materials were sent by the Regional Museum of Natural Sciences of Turin (Luca Picciau), the Natural History Museum of Udine (C. Morandini), and the Zoologische Staatssammlung, Munich, Germany (A. Hausmann, A. Segerer). A significant contribution is due to the rearings of some species in the laboratory, especially *B. cinereopunctella*, *B. fulgens*, *B. juliensis* and *B. utonella*, which allowed the study of the genital structure and the spermatheca on large series of specimens. Regarding the spermathecae, it was possible, thanks to a special technique, to avoid the morphological changes that occur in normal preparations as a result of the pressure made by the cover glass. The abdomen, after the usual staining in Black Khlora-zol and the washes in increasing alcohol grade and then in Euparal essence, is transferred onto the microscope slide in one or two large drops of rather fluid Euparal, in which the dissection is carried out and the spermatheca is isolated without detaching it from the ductus bursae. A drop of essence is added to the Euparal and, with a thin strip of filter paper the impurities are removed as much as possible. At this point the spermatheca floats in a clean field, while maintaining its normal configuration. After a dozen hours in Euparal, which is by then quite hard, a drop of fresh Euparal is added and only then the cover slip is applied. Genital structure and spermatheca become again perfectly legible.

Results

The genus *Biselachista* Traugott-Olsen & Nielsen, 1977: 252

Type species: *Biselachista freyi* Staudinger 1870

Diagnosis: The wingspan of adults ranges from 5 to 11 mm. With regard to the habitus, in most of the species, some small white or silver white spots stand out on the dark ground of the forewing. In other taxa, such as *B. albidella* or *B. contaminatella*, ochre tones prevail, with tiny strips or groups of blackish scales. Finally, the wings of *B. brachypterella* have a uniform light dark ochre colour.

Male genitalia: Uncus lobes more or less developed, but always with the apex rounded, ventrally with thin setae, rod-shaped or, more rarely, clavate. Gnathos always bilobed. Valva: cucullus generally rounded; in *B. albidella*, *B. contaminatella* and *B. igaloensis* sacculus is produced into a spine below the cucullus; the basal fold of valva is interrupted by a poorly sclerotized stretch, shortly from the base, which separates a falciform area from the rest of the costa (Fig. 1d); juxta lobes sometimes with a small tuft of long setae on apical margins; digitate process big claviform or small and thin, curved; vinculum without saccus; aedeagus from short and stubby to long and slender, vesica with a tubular

sclerotization (Fig. 1e) or a thin cornutus or, finally, with a long robust and toothed cornutus as in *B. serricornis*.

Female genitalia: Antrum bowl-shaped or more rarely funnel-shaped, dorsal wall often with fine spines. The colliculum very short, except in *B. fulgens*, *B. juliensis* and *B. zonulae*, compared to the length of the ductus bursae, is involved by a groove running up to the entrance of the ductus seminalis. Bursa generally ovoid or pyriform, sometimes broadly covered with a distinctive internal granulation; signum: missing in *B. brachypterella* and *B. trapeziella*, in the other species it may be a poorly sclerotized area with a longitudinal line of small teeth or a more or less evident toothed plate.

Spermatheca: fecundation duct with few spirals; spermatheca shaped like an inverted C that is connected with a single loop and a short membranous stretch to the utricule (Fig. 1, a, b, c).

Biology: The biology of the species of genus *Biselachista* is well known and the behaviour of the pre-imaginal stages does not deviate from that already known in other groups of the family Elachistidae living at the expense of monocotyledons. The egg is glued on the leaf page and the young larva bores the chorion and penetrates into the leaf parenchima. The mine is a thin tunnel at the beginning and it extends gradually until it involves the entire leaf blade. The larvae bore mainly Cyperaceae leaves and, to a lesser extent, those of Gramineae and Juncaceae. The tergal, sternal and anal plates have, with few exceptions, a strong sclerotization (Fig. 34). The two prothoracic tergal plates, separated from each other, have an L shape, with the lower branch variously conformed. The two sternal plates, separated as well, are elongated and thin, while the anal one reminds of a wide shield. Pupation takes place on the stems of the food plant and the pupa is attached to the substrate with the cremaster and a silk belt, while in the absence of the latter, it is protected by a thick silk net.

Check-list of European *Biselachista* Traugott-Olsen & Nielsen, 1977

Biselachista albidella (Tengström, [1848], in Nylander)
Biselachista brachypterella Klimesch, 1990
Biselachista cinereopunctella (Haworth, 1828)
Biselachista contaminatella (Zeller, 1847)
Biselachista eleochariella (Stainton, 1851)
Biselachista fulgens (Parenti, 1983), **comb. n.**
Biselachista igaloensis (Amsel, 1951)
Biselachista imatrella (Schantz, 1971)
Biselachista juliensis (Frey, 1870)
Biselachista kebneella Traugott-Olsen & Nielsen, 1977
Biselachista morandinii (Huemer & Kaila, 2002), **comb. n.**
Biselachista ornithopodella (Frey, 1859)
Biselachista scirpi (Stainton, 1887)
Biselachista serricornis (Stainton, 1854)
Biselachista trapeziella (Stainton, 1849)
Biselachista utonella (Frey, 1856)
Biselachista zonulae Sruoga, 1992, in Sruoga & Puplesis

Biselachista albidella (Tengström, [1848], in Nylander)
Elachista albidella Tengström [1848], in Nylander: 150.
Aphelosetia rhyncosporella Stainton, 1848: 2165.
Poeciloptilia uliginosella Herrich-Schäffer, 1855: 310.
Elachista tanyopsis Meyrick, 1932: 218.

Diagnosis: Wingspan, 9-10 mm. Male (Fig. 40) and female (Fig. 41): head and neck tufts white.

Ground colour of forewing white, suffused with ochreous; an elongate black streak in the middle of the plica.

Male genitalia (Fig. 2): Uncus lobes wide, elongated, with the apex rounded, ventrally with long and thin setae. Valva: cucullus as a prominent semicircular lobe, projecting dorsally, below into a distinct spine. Aedeagus straight, shorter than the valva, that tapers slightly at the distal end: vesica with a tubular sclerotization.

Female genitalia (Fig. 18): Antrum bell-shaped. A little after the colliculum, the walls of the ductus bursae are involved by a series of long and thin longitudinal folds that include also the first part of the bursa. Signum: a line, often interrupted in the middle, of few small teeth in the centre of a poorly sclerotized area.

Biology: Host plants. Graminaeae: *Calamagrostis arundinacea*, *Deschampsia cespitosa*, *D. flexuosa*, *Melica nutans*, *Poa palustris*. Cyperaceae: *Carex acuta*, *C. acutiformis*, *C. riparia*, *Eleocharis palustris*, *Eriophorum angustifolium*, *Scirpus caespitosus* (PARENTI & VARALDA, 1994).

Distribution: Holarctic: North America (KAILA, 1996), Europe and Japan (SUGISIMA, 1999).

Biselachista brachypteryella Klimesch, 1990

Biselachista brachypteryella, Klimesch, 1990: 138.

Diagnosis: Male (Fig. 42): wingspan, 9-11 mm. Head and thorax from white to ochre. The light ochre ground colour of the forewing appears mottled due to the presence of several darker scales. Female (Fig. 43): apart from the smaller size of wings, wingspan 6-8 mm, similar to the male.

Male genitalia (Fig. 3): Uncus lobes short and stubby, with rod-shaped setae rounded apically. Distal margin of juxta lobes with few long setae. Aedeagus slightly sinuous, as long as the valva: vesica with a tubular sclerotization.

Female genitalia (Fig. 19): Antrum open bowl-shaped. Colliculum sclerotized, 1/3 of the ductus bursae in length. Bursa oval, with no signum or microsclerifications.

Biology: Unknown.

Distribution: Known from the type locality (Italy, Trentino-Alto Adige, Passo di Monte Croce di Comelico, Sesto, BOLZANO) and Austria, Östtirol (HUEMER, 2000).

Notes: The female genitalia of *brachypteryella* are similar to those of *trapeziella*. The most significant difference is found in the tract of the colliculum at its insertion in the ductus bursae. In *brachypteryella* this part shows an expansion, while in *trapeziella* it maintains its diameter and it bends to form a clear curve.

Biselachista cinereopunctella (Haworth, 1828)

Tinea cinereopunctella Haworth, 1828: 581.

Diagnosis: Wingspan 7-9 mm. Male (Fig. 44): on the dark brown ground of the forewing there is a whitish band, often interrupted, and two evident tornal and apical spots, of the same colour. Female (Fig. 45): patterns of the forewing more marked than in the male and pure white.

Male genitalia (Fig. 4): On the ventral surface of the small lobes of the uncus there are several rod-shaped setae with a rounded apex. Aedeagus straight, as long as the valva; vesica with a tubular sclerotization.

Female genitalia (Fig. 20): Antrum funnel-shaped. Colliculum short and poorly sclerotized. Bursa small, ovoid. Signum: an irregular plate crossed by thin strips slightly serrated or with tiny scattered teeth.

Biology: Described by STEUER (1978). The larva, 5-6 mm long, differs from that of the other Elachistids in the presence of two evident red bands dorsally and one ventrally; it bores the leaves of *C. humilis* and *C. flacca*. Sclerotized plates of the larva (Fig. 34a, b, c). Pupa (Fig. 35): in the pupa, similar to that of *B. trapeziella*, there are still traces of the larval coloured bands - Host plants. Gramineae: *Sesleria caerulea*. Cyperaceae: *Carex digitata*, *C. ericetorum*, *C. flacca*, *C. hornithopoda*, *C. humilis*, *C. morrowii*, *C. pilosa* (PARENTI & VARALDA, 1994).

Distribution: Transpalaeartic from northern and central Europe, British Isles included, to Far Eastern Russia (SINEV & SRUOGA, 1995) and Japan (SUGISIMA, 2005).

Biselachista contaminatella (Zeller, 1847)

Elachista contaminatella Zeller, 1847: 892.

Elachista fadella Millière, 1876: 364.

Elachista suspectella Chrétien, 1896: 192.

Aphelosetia hypoleuca Walsingham, 1907: 968.

Biselachista spinigera Sruoga, 1990: 79.

Diagnosis: Wingspan, 8 - 10 mm. - Male (Fig. 46) and female (Fig. 47): head from white to light ochre. Ground colour of the forewing white, that may be sometimes more or less dark for the presence of brown scales; a distinct black dash at about halfway up the wing, in the plica.

Male genitalia (Fig. 5): Uncus lobes small, with few thin setae. Valva: cucullus as a prominent round lobe, projecting dorsally into a slender spine. Ventral region of juxta with a short conical process. Aedeagus slightly shorter than the valva, with a tubular sclerotization.

Female genitalia (Fig. 21): Antrum bowl-shaped. After the short colliculum, the ductus bursae expands gradually until it flows with no narrowing into the bursa. Corpus bursae: signum as a serrated strip in the middle of a poorly sclerotized area.

Biology: Parasitoid. Hymenoptera, Braconidae: *Bracon osculator* Nees (PARENTI *et al.*, 1995) - Host plants. Cyperaceae: *Carex distans* (ex coll. J. Szöcs).

Distribution: From Albania, Algeria, Austria, Bulgaria, Canary Islands, Corsica, Croatia, France, Hungary, Iberian Peninsula, Italy, Morocco, Sardinia, Sicily, Slovakia, Turkey, East Russia to Mongolia (Kaszab exp., 1967, 1,500 m).

Biselachista eleochariella (Stainton, 1851)

Elachista eleochariella Stainton, 1851: 10.

Diagnosis: Wingspan 7-8 mm. Male (Fig. 48) and female (Fig. 49). Head from white to grey. Ground colour of the forewing from yellowish white to more or less dark ochre; a distinct black dash at about halfway up the wing, in the plica.

Male genitalia (Fig. 6): Uncus lobes ventrally covered with very few thin setae. Valva slightly bent, cucullus small, rounded towards costa and sacculus. Digitate processes spatula-shaped. Aedeagus, slightly shorter than the valva, tapers in the distal tract; vesica with a tubular sclerotization.

Female genitalia (Fig. 22): Antrum cup-shaped; inner side with fine spines. The ductus bursae remains isodiametrical for about half of its length and then increases gradually its diameter until it flows into the bursa with no narrowing. Signum: a poorly sclerotized area with a longitudinal dentate ridge in the middle.

Biology: Host plants. Cyperaceae: *Carex flacca*, *C. panicea*, *Eleocharis palustris*, *Eriophorum angustifolium*. Pupa (Fig. 36).

Distribution: Holarctic: from North and Central Europe, British Isles included, to Far East Russia (SINEV & SRUOGA, 1995), also recorded from Canada (KAILA, 1996).

Biselachista fulgens (Parenti, 1983), **comb. n.**

Elachista fulgens Parenti, 1983: 5.

Biselachista arnoldi Koster, 1993: 61.

Diagnosis: Wingspan 5-8 mm. Male (Fig. 50) and female (Fig. 51): bronze head; antenna distinctly serrate. On the bronze ground of the forewing, spotted by scattered yellowish scales, a basal area of white stands out, as well as the fascia before the middle and the small spot inside the angle made by the costal and tornal spots when, as almost always, they are confluent.

Male genitalia (Fig. 7): Uncus lobes elongated, almost rectangular, with the apex rounded; ventrally covered with numerous setae. Distal margin of juxta lobes with few long setae. Gnathos lobes

large, round. Aedeagus straight, tapering towards the sharp tip and curved dorsally; vesica with a tubular sclerotization.

Female genitalia (Fig 23): Antrum bowl-shaped. The walls of the long colliculum show a short stretch more sclerotized before the insertion into the ductus seminalis. Bursa oval with an evident signum.

Biology: The fully-grown larva, 5-5.5 mm long, has the colour of old wax with greenish hues. Sclerotized plates of the larva (Fig. 34d, e, f). The pupa (Fig. 37), attached to the substrate only by the cremaster, is protected by a thick silk web. - Host plants. Cyperaceae: *Carex acutiformis*, *C. elata*, *C. oahuensis* (SUGISIMA, 2005), *C. riparia*.

Distribution: Transpalearctic from Europe (the Netherlands, Croatia, Germany, Hungary, Italy), to Japan.

Biselachista igaloensis (Amsel, 1951)

Elachista igaloensis Amsel, 1951: 414.

Diagnosis: Wingspan, 6-7 mm. Male (Fig. 52) and female: before the white median fascia, there is a long dark brown spot in the plica. After the fascia, there is an irregular ochre-coloured area.

Male genitalia (Fig. 8): Uncus lobes faintly marked, ventrally with rod-shaped setae. Valva: sacculus with a distal spine. Digitate processes like a slender club. Aedeagus sinuous with a basal appendix; vesica with a tubular sclerotization.

Female genitalia (Fig. 24): Antrum funnel-shaped. Bursa pyriform. Signum: a poorly sclerotized plate with two big curved teeth which remind one of *Elachista biatomella* Stainton.

Biology: Unknown.

Distribution: Corsica, Croatia, Yugoslavia, Sardinia, Spain (Catalonia).

Biselachista imatrella (Schantz, 1971)

Elachista imatrella Schantz, 1971: 99.

Notes: Of *imatrella* only eight males are known, including three of the type series, and a female without abdomen (MUTANEN & ITÄMIES, 2006). According to these authors "The *E. imatrella* male is externally similar to that of *cinereopunctella*". The two species would be "reliably distinguishable based on the male genitalia, particularly the aedeagus, which is both absolutely and relatively longer in *E. imatrella*". For now, however, some doubts on the validity of this taxon remain. Some new and more numerous specimens and, most importantly, the examination of female genitalia are fundamental for a definitive conclusion.

Biselachista juliensis (Frey, 1870)

Elachista juliensis Frey, 1870: 279. "Lectotype" "*E. juliensis* Frey Engadin" "Frey Coll. Brit. Mus. 1890-62" gen. slide B.M. ♂ N° 19382 U. Parenti"

Elachista freyi Staudinger, 1870: 322. "1984 ♂ E. Traugott-Olsen Lectotype 27.3.74/Eto" "*Elachista freyi* Stgr. leg. O. Staudinger Macugnaga 22/7"

Elachista occidentalis Frey, 1882: 372. "Lectotype" "*E. occidentalis* Frey Crassier (Leriol)" "Frey Coll. Brit. Mus. 1890-62" "gen. slide B.M. ♂ N° 19383 U. Parenti"

Biselachista klimeschi Traugott-Olsen, 1994: 326.

Biselachista buvati Traugott-Olsen, 1994: 327.

Biselachista ruthae Traugott-Olsen, 1994: 330.

Biselachista ingeborgae Traugott-Olsen, 1994: 332.

Diagnosis: Wingspan 6-7 mm -. Male (Figs. 53, 55) and female (Figs. 54, 56): head from white to grey. Forewing ground colour from grey to brownish with five white spots, one basal, one situated in the plica before the middle of the wing, one costal, one tornal, and one apical. The spots, in particular the basal and apical ones, may be missing or very small. In females, the pattern is more pronounced.

Male genitalia (Fig. 9): Uncus lobes more or less elongated, distally rounded, with many long

setae ventrally. Distal margin of juxta lobes from curved (Fig. 12a) to more or less incised in the middle stretch (Fig. 12b), but always with few long setae. Aedeagus sinuous; vesica with a thin cornutus.

Female genitalia (Fig. 25): The shape of the antrum may differ, from that of an elongated bowl (Fig. 25a) to that of a funnel (Fig. 25d) with a series of intermediate models (Fig. 25b, c). The sclerotization of the long colliculum extends from the antrum until just before the insertion of the ductus seminalis. Corpus bursae largely covered with conspicuous sclerotized granules; signum as an elongate dentate plate of a variable shape.

Biology: Described by STEUER (1978) sub *Elachista freyi*. The larva, yellow and 4-4.5 mm long, lives on *Carex humilis*; other host plants are *Carex digitata* and *C. ericetorum* (KAILA & VARALDA, 2004, sub *E. occidentalis*) and *C. pilosa* (Coll. Szocs).

Distribution: Widespread in Europe from Portugal to Greece, from North Italy to Finland.

Notes: KAILA & VARALDA (2004) have dealt with what is called the "*Elachista juliensis* - complex" to which they assign three European species: *E. juliensis* Frey (= *E. freyi* Staudinger), *E. occidentalis* Frey and *Elachista zonulae* Sruoga. Particular attention is given to the first two taxa, of which they give an account of their long and troubled systematic history. A careful analysis is devoted to male and female genitalia. According to the Authors, the separation of the males of *juliensis* from those of *occidentalis* is usually possible by considering above all the morphology of the uncus lobes and of the distal margin of the juxta lobes. The uncus lobes are slightly longer than wide in *juliensis*, about 1.3 times longer than wide in *occidentalis*. The distal margin of juxta lobes is almost straight in the first species, somewhat rounded in the second one. Concerning female genitalia, the morphology of the antrum differs between *E. juliensis* and *E. occidentalis*: the antrum is distinctly wider than deep in *E. juliensis*, as wide as deep in *E. occidentalis*.

The examination and dissection of a large number of specimens obtained from laboratory rearings allowed us to demonstrate that these characters are subject to a significant variability. In specimens of the same rearing, in fact, the length/width ratio of the uncus lobes may vary from the model shown as valid to identify *juliensis* to that considered equally valid for *occidentalis*, with several intermediate situations. Also the distal margin of juxta lobes may be, in individuals of the same rearing, almost straight, rounded (Fig. 9a) or showing a more or less marked step (Fig. 9b). On the other hand, if the morphology of the uncus and of the juxta lobes were discriminant characters the Lectotypus of *E. freyi* (*freyi* is a synonym of *juliensis*) (Fig. 9), would be easily identified as *E. occidentalis*.

In females the situation is similar: the morphology of the antrum in specimens of the same rearing varies significantly (Fig. 25, b, c, d) and the same happens in individuals collected in the field (Figs. 25 and 25a).

At this point it seems clear that, based on current knowledge, it is not possible to assign with absolute certainty either males or females to *juliensis* or *occidentalis* that, beyond any reasonable doubt, must be considered a single species with *occidentalis* as a synonym of *juliensis*.

Biselachista kebneella Traugott-Olsen & Nielsen, 1977

Biselachista kebneella Traugott-Olsen & Nielsen, 1977: 259.

Elachista saarelai Kaila & Sippola, 2010: 131. **syn. n.** "Finland E. H: Tampere 681: 33 Herv. etela ex l. 2009 Leo Sippola leg. " "Paratypus *Elachista saarelai* Kaila & Sippola" "Coll. ZMUC Copenhagen" "gen. slide ♂ N° 15652 U. Parenti"

Diagnosis: Wingspan 8-9 mm. Male (Fig. 57) and female: head, thorax and tegulae dark grey. Forewing ground colour grey-brown with four or five whitish marks, two of which aligned along the plica.

Male genitalia (Fig. 10): Uncus lobes lasrge, rounded, divided by a deep V-shaped cut, ventrally covered with short scales distally widening. Distal margin of juxta lobes without setae. Aedeagus shorter than the valva; vesica with an elongated tubular sclerotization.

Female genitalia (Fig. 26): Antrum bowl-shaped; dorsal wall with fine spines. Length of the

colliculum 1/6 of that of the ductus bursae. Bursa oval; signum as an irregular and poorly sclerotized plate with numerous cup-shaped microstructures.

Biology: Described by KAILA & SIPPOLA (2010). Hostplants. Cyperaceae: *Carex digitata*. The development of the larva takes two years, during which it feeds in the good season, while it spends two winters in diapause inside a mine. The larva pupates on the leaf of the hostplant.

Distribution: Finland (KERPPOLA, 1997; KAILA & SIPPOLA, 2010), Sweden.

Biselachista morandinii (Huemer & Kaila, 2002), **comb. n.**

Elachista (*Elachista*) *morandinii* Huemer & Kaila, 2002: 212.

Diagnosis: Wingspan 8-9 mm. Male and female (Fig. 58): from the original description “Head white, thorax and tegulae plain white; forewing ground colour white; basal 3/5 of costa dark brown; ochreous stripe in fold usually with a dark dot in middle of wing distinct dark brown fringe line from apex almost to tornus. Hindwing dark grey-brown with concolorous fringes.”

Male genitalia (Fig. 11): Uncus lobes nearly square, ventrally densely covered with scales that spread slightly on the distal stretch. Distal margin of juxta lobes slightly convex. Valva widest medially; cucullus rounded. Digitate processes large, clavate. Aedeagus, 2/3 the length of the valva, bending slightly dorsad in the distal stretch; vesica with a tubular sclerotization.

Female genitalia (Fig. 27): Dorsal wall of antrum bowl-shaped, densely covered by small spines that surround the border too; also the ostium bursae has a dense covering of spines. The ductus bursae, immediately after the short colliculum, gradually increases in diameter until it flows into the corpus bursae. Signum: an irregular area, slightly sclerotized, with a transversal line of minute teeth.

Biology: Host plant. Cyperaceae: *Carex panicea*.

Distribution: France (Vannes, Bretagne), Italy, Southern Hungary.

Biselachista ornithopodella (Frey, 1859)

Elachista ornithopodella Frey, 1859: 194.

Diagnosis: Wingspan, 6-8 mm. Male (Fig. 59): forewing ground colour blackish tinged dark brown, with four pure white marks, one near the base, a median fascia, often interrupted, and two apical and costal spots. Female (Fig. 60): forewing marks more prominent and distinct.

Male genitalia (Fig. 12): Uncus lobes ventrally covered with numerous rod-like setae. Digitate processes shaped like a slender club. Aedeagus slightly sinuous, 1/3 shorter than the valva; vesica with a tubular sclerotization.

Female genitalia (Fig. 28): Antrum bowl-shaped. Colliculum narrow. Bursa elongated, pyriform, with a small and elongated signum.

Biology: Described by STEUER (1987). The larva, of an intense yellow colour, 5.5 mm long, bores the leaves of *Carex montana*, *C. ornithopoda* and *Carex sempervirens*.

Distribution: Reported in Austria, Czech Republic, Finland, Germany, Italy, Rumania, Northwest Russia, Switzerland.

Biselachista scirpi (Stainton, 1887)

Elachista scirpi Stainton, 1887: 253.

Biselachista margaretae Traugott-Olsen, 1994: 333.

Diagnosis: Wingspan, 8-11 mm. Male (Fig. 61) and female (Fig. 62): head, tegulae and thorax from cream-white to ochreous. Forewing ground colour varying from ochreous to white. A distinct black dash in the middle of the wing in the plica.

Male genitalia (Fig. 13): Uncus lobes ventrally covered by numerous thin setae. Valva: cucullus prominent, rounded; digitate processes curved and slender. Aedeagus stout, shorter than the valva; vesica with a tubular sclerotization.

Female genitalia (Fig. 29): Antrum bell-shaped; the ductus bursae, from the short and sclerotized colliculum, widens gradually up to the bursa. Signum: a strip of minute teeth in the middle of a very limited and poorly sclerotized area.

Biology: Larva pale greenish yellow. Pupation takes place in a fine silk web. - Parasitoid. Hymenoptera, Braconidae: *Apanteles laetus* Marshall (PARENTI *et al.*, 1995). - Host plants. Juncaceae: *Juncus gerardii*, *J. compressus*. Cyperaceae: *Scirpus maritimus*.

Distribution: North Europe and from the British Isles to Austria, Belgium, Corsica, Croatia, Germany, Greece, Hungary, Iberian peninsula, Italy, the Netherlands, Rumania, Sardinia, Sicily, Turkey.

Biselachista serricornis (Stainton, 1854)

Elachista serricornis Stainton, 1854: 260.

Elachista serricornella Morris, 1870: 227.

Elachista mitterbergeri Rebel, 1906: 643.

Elachista preisseckeri Krone, 1911: 40.

Diagnosis: Wingspan, 7-9 mm. - Male (Fig. 63): antenna strongly serrate. On the ground colour of the forewing, mottled with a mixture of brown and white scales, minute and irregular areas of an ochre colour stand out; towards the apex there is a yellowish white triangular strip. Female (Fig. 64): similar to the male, but the antennae are less serrate.

Male genitalia (Fig. 14): Uncus lobes clavate, with thin rod-like setae. Lobes of gnathos big and rounded. Distal margin of juxta lobes with few setae. Vinculum very developed. Aedeagus long and slender with a long cornutus that shows 4-5 robust teeth in the distal stretch.

Female genitalia (Fig. 30): Papillae anales short. Antrum bowl-shaped. Colliculum short 1/4 of the length of the ductus bursae. Corpus bursae oval with the signum dentate at the ends.

Biology: The larva, grey-greenish with a whitish dorsal line (HERING, 1891; MEYRICK, 1928), overwinters inside the mine and in spring it feeds a little before cocooning protected by a thick silk cover. Pupa (Fig. 38). Host plants. Cyperaceae: *Carex elata*, *C. ericetorum*, *C. ferruginea*, *C. sylvatica*, *Carex vesicaria*, *Eriophorum angustifolium* (stem, HECKFORD, 1999), *E. vaginatum*, *Scirpus sylvaticus*.

Distribution: North and central Europe, British Isles included. Not reported in France.

Notes: The male genital structure of the two North American species, *Elachista huron* (Quebec) and *E. serra* (Labrador), described by KAILA (1996) remind very much that of *serricornis*.

Biselachista trapeziella (Stainton, 1849)

Elachista trapeziella Stainton, 1849: 26.

Diagnosis: Wingspan, 8-10 mm. Male (Fig. 65): five minute whitish spots on the dark ground of the forewing. Female (Fig. 66): the five spots are generally larger and with a distinct silvery sheen, the two in the middle of the wing tend to merge, giving rise to a more or less complete band.

Male genitalia (Fig. 15): Uncus lobes very short, ventrally covered with rod-shaped setae. Digitate processes shaped like a slender club. Distal margin of juxta lobes with few long and robust setae. Aedeagus sinuous, as long as the valva: vesica with a tubular sclerotization.

Female genitalia (Fig. 31): Antrum small, bowl-shaped. The colliculum, sclerotized, forms a loop in the insertion point of the ductus bursae. Bursa small, oval, without signum.

Biology: Described by BLAND & KNILL-JONES (1988) and by BLAND (1996). - Host plants. Juncaceae: *Luzula luzuloides*, *L. pilosa*, *L. sylvatica*. Parasitoid. Hymenoptera, Braconidae: *Apanteles viminetorum* Wesmael (PARENTI *et al.*, 1995).

Distribution: From southern Scandinavia and Finland throughout central Europe and British Isles.

Biselachista utionella (Frey, 1856)

Elachista utionella Frey, 1856: 300.

Elachista caricis Stainton, 1859: 155.

Elachista paludum Frey, 1859: 283.

Elachista palustrella Morris, 1870: 225.

Elachista carinisella Morris, 1870: 225.

Diagnosis: Wingspan, 8-9 mm. - Male (Fig. 67) and female: head from grey to white. Forewing ground colour generally grey-brown with white marks; along the plica and starting from the base of the wing there is a long whitish area, at the end of which a short, blackish streak appears.

Male genitalia (Fig. 16): Uncus lobes stout ventrally covered with setae spreading distally so to form some slender clubs. The valva curves dorsad, ending in the rounded cucullus. Digitate processes big, oval. Aedeagus slightly shorter than the valva, that bends dorsally in the distal stretch: vesica with a tubular sclerotization.

Female genitalia (Fig. 32): Antrum: a big calyx, often as long as the anterior apophyses, with numerous spines on the dorsal wall. Bursa ovoid; signum: a longitudinal series of minute teeth in the middle of a faintly sclerotized area.

Biology: Pupa (Fig. 39). Host plants. Juncaceae: *Juncus gerardi* - Gramineae: *Festuca* sp. - Cyperaceae: *Carex bryzoides*, *C. dispalata*, *C. distans*, *C. disticha*, *C. echinata*, *C. elata*, *C. flacca*, *C. hirta*, *C. lyngbyei*, *C. muricata*, *C. paniculata*, *C. pumila*, *C. remota*, *C. rhynchophysa*, *C. riparia*, *C. sadoensis*, *C. spicata*, *C. thunbergii*, *C. vesicaria*, *Scirpus sylvaticus*, *S. wichurae*.

Distribution: Transpalaeartic, from Europe to Far East Russia and Japan (SUGSIMA, 1999).

Biselachista zonulae Sruoga, 1992

Biselachista zonulae Sruoga, 1992, in Sruoga & Puplesis: 440.

Description: Wingspan 6-7 mm. Male (Fig. 68): head, neck tuft, and thorax mottled grey. Forewing ground colour dark grey, with three greyish white markings. Female (Fig. 69) like the male but forewing ground colour darker with brighter and more expanded white pattern.

Male genitalia (Fig. 17): Uncus lobes long and slender, ventrally covered with short rod-shaped setae. Digitate processes clavate. Distal margin of juxta lobes with few setae. Aedeagus long a little less than the valva, curving evidently at about 1/3 from the base; vesica with a short and thin cornutus.

Female genitalia (Fig. 33): Antrum small, if compared to that of *B. juliensis*, funnel-shaped, dorsal wall spinose. Colliculum long, slender, sclerotized up to the insertion of the ductus seminalis; bursa large, suboval, with some granular microsclerotizations and a big toothed signum.

Biology: BARAN (2003), based on BUSZKO & BARANIAK (1989), reports the larva to feed on *Carex sempervirens*.

Distribution: Transpalaeartic from Austria, France, to Kyrgyzstan, Kazakhstan (SRUOGA & PUPLESIS, 1992), Poland (Tatra mts.), Russia (Altai Mts.), Slovakia, Tajikistan (SRUOGA & PUPLESIS, 1992).

Discussion

The genus *Biselachista*, with a Holarctic distribution, currently includes seventeen European species. The wingspan of adults ranges from 5 to 11 mm. The forewing colour varies from dark grey with white or silver whitish spots to a uniform ochre colour.

The male genitalia are characterized by the peculiar morphology of the valva, the costal edge of which is interrupted by a poorly sclerotized stretch, a little distant from the base, which separates a falciform area from the rest of the costa.

In females it should be noted, with a few exceptions, that the colliculum is poorly developed compared to the length of the ductus bursae, while the model of the spermatheca is common to all taxa.

The biology of some species is well known thanks to laboratory rearings. The larvae are leaf-miners mainly of Cyperaceae and, to a lesser extent, of Gramineae and Juncaceae. The prothoracic and anal plates are generally well sclerotized. As parasitoids, we mention the Braconidae *Apanteles laetus* Marshall and *Apanteles viminetorum* Wesmäl. The pupa may present the two furrows between the IVth and Vth and between Vth and VIth abdominal segment and in this case it clings to the substrate with the cremaster and a silk belt; when these grooves are lacking, the pupa is protected by a dense silky web.

The examination of the type material permitted us to ascertain the following synonymies:

Elachista occidentalis (Frey, 1882) is a synonym of *Biselachista juliensis* (Frey, 1870); *Elachista saarelai* Kaila & Sippola, 2010 is a synonym of *Biselachista kebneella* Traugott-Olsen & Nielsen, 1977.

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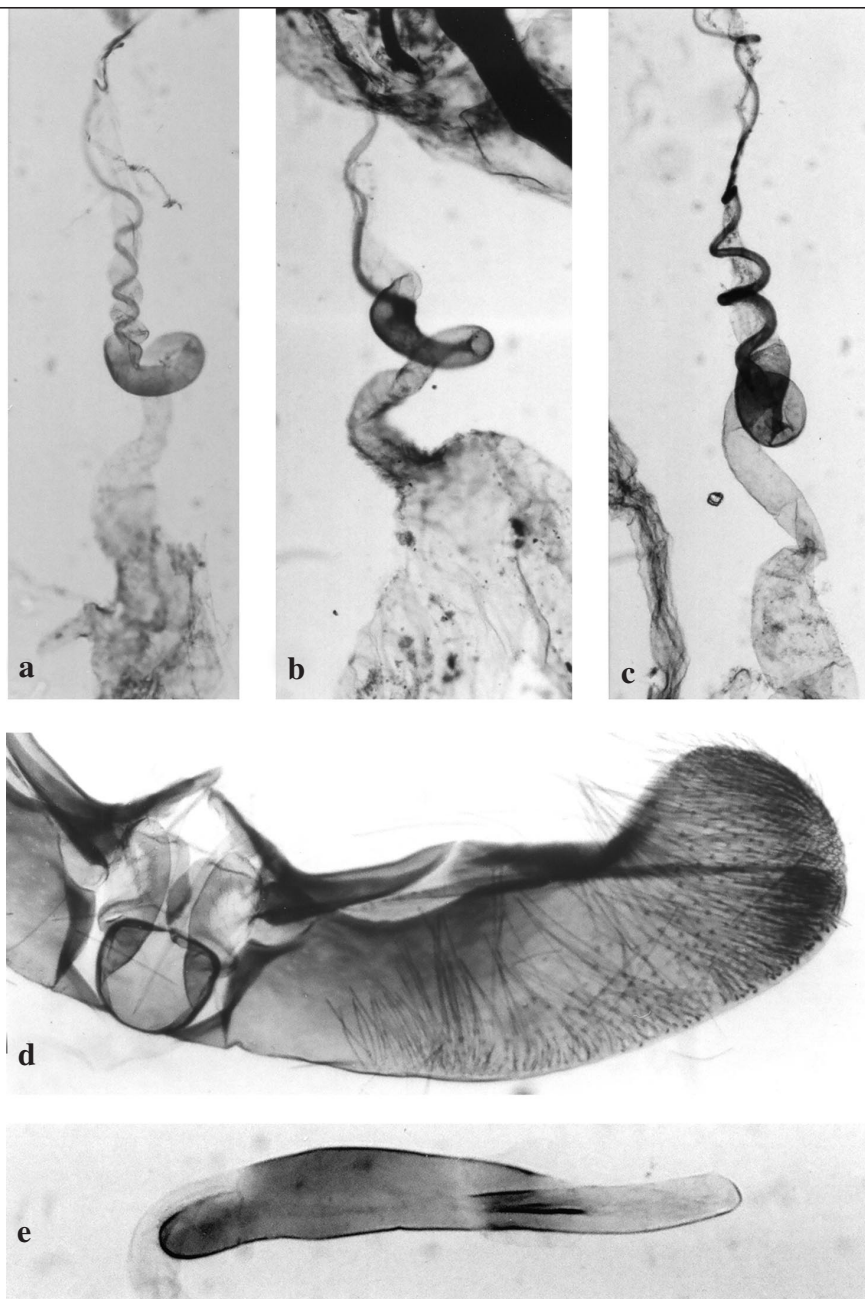
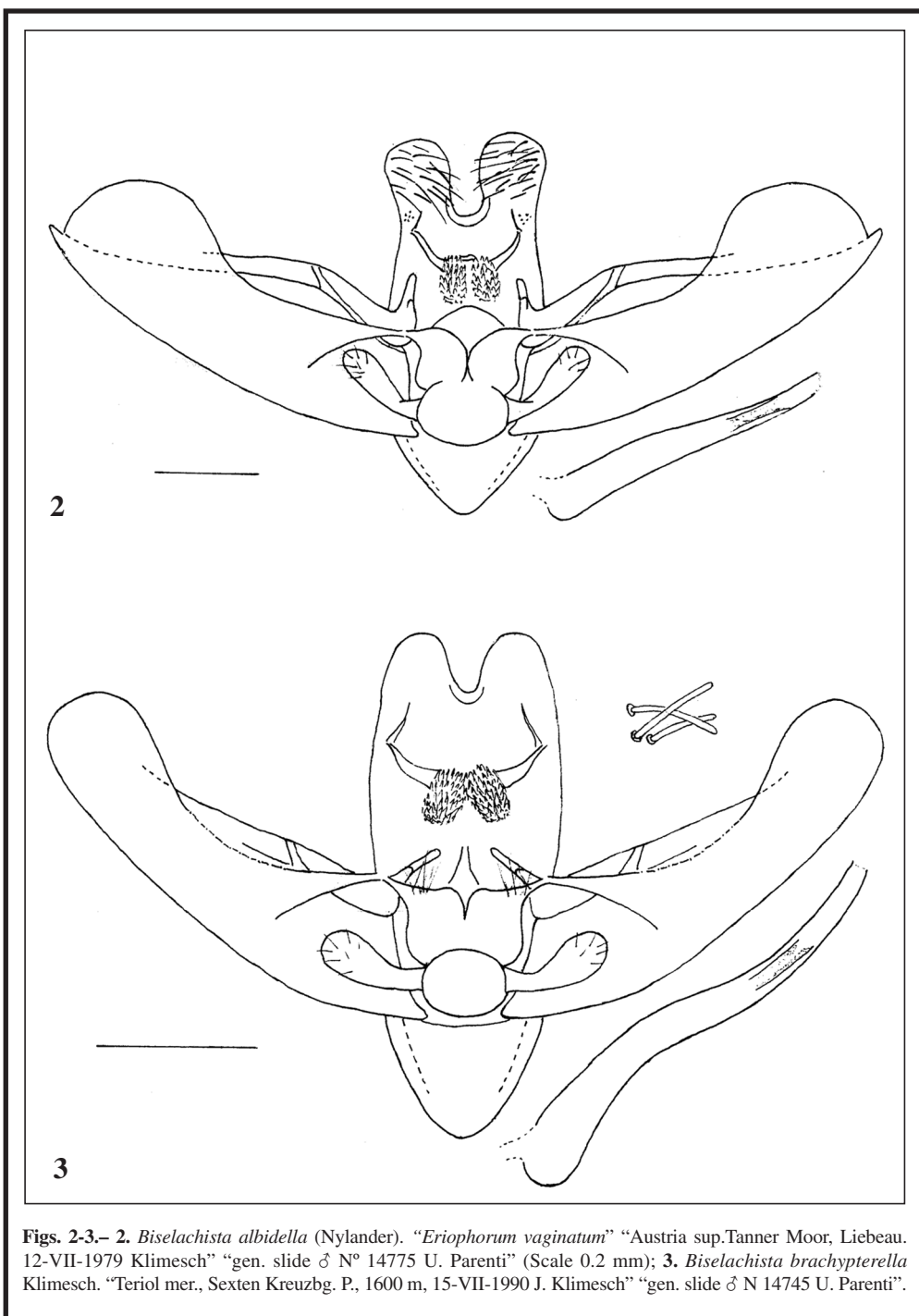
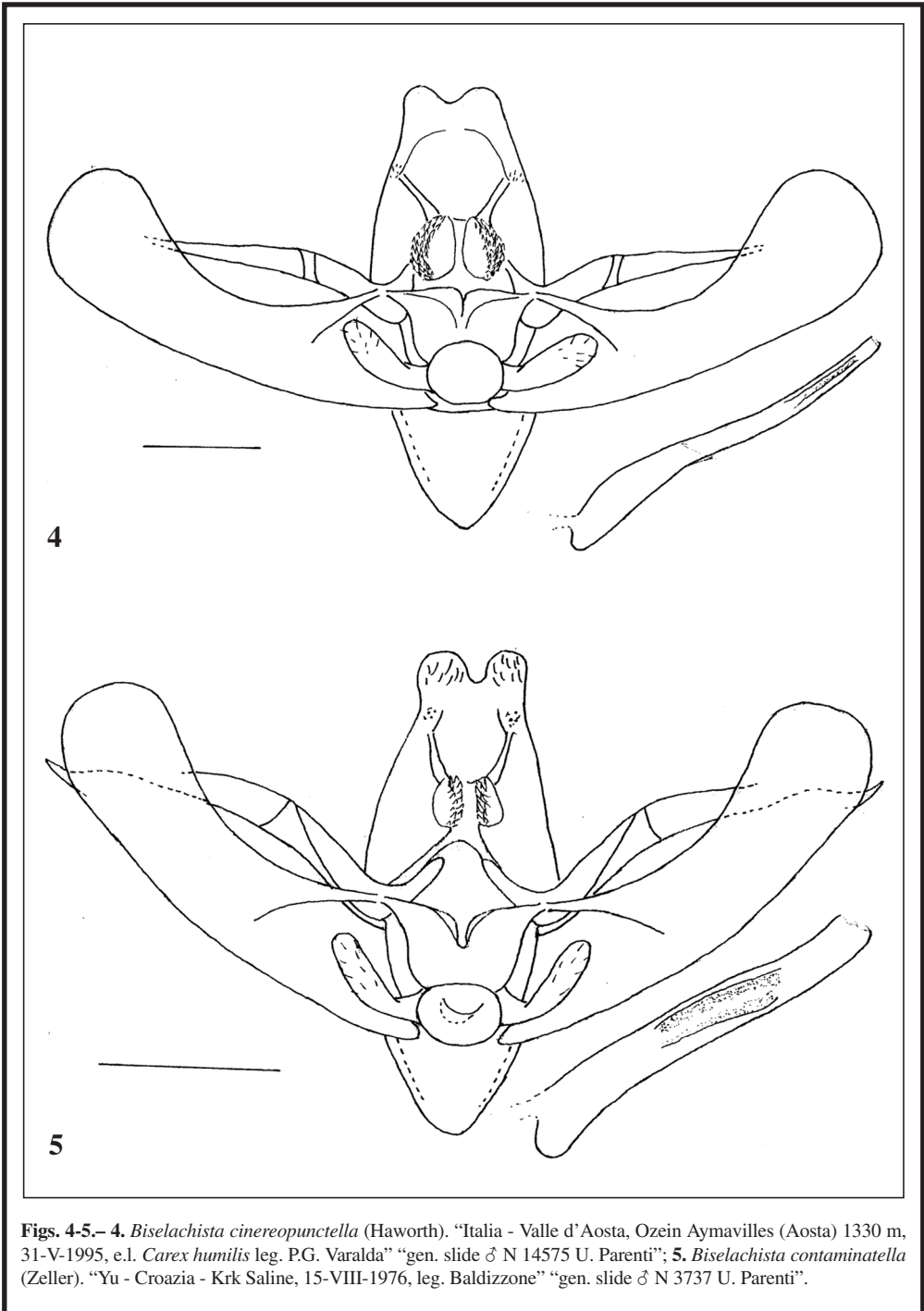


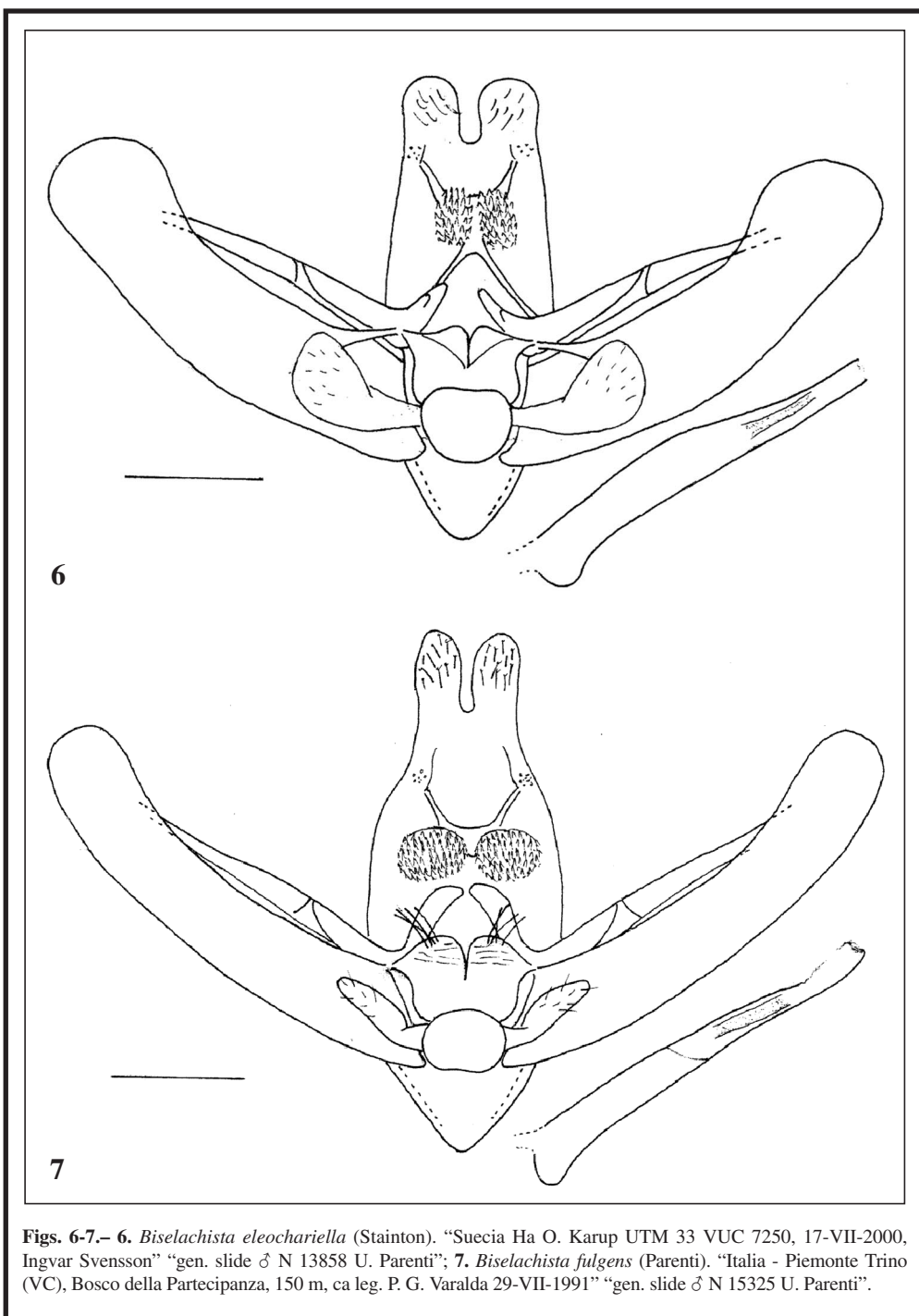
Fig. 1.— Spermathecae of: **a)** *B. juliensis* (Frey); **b)** *B. albidella* (Nylander); **c)** *B. contaminatella* (Zeller); **d)** valva of *B. scirpi* (Stainton); **e)** aedeagus of *B. albidella* (Nylander).

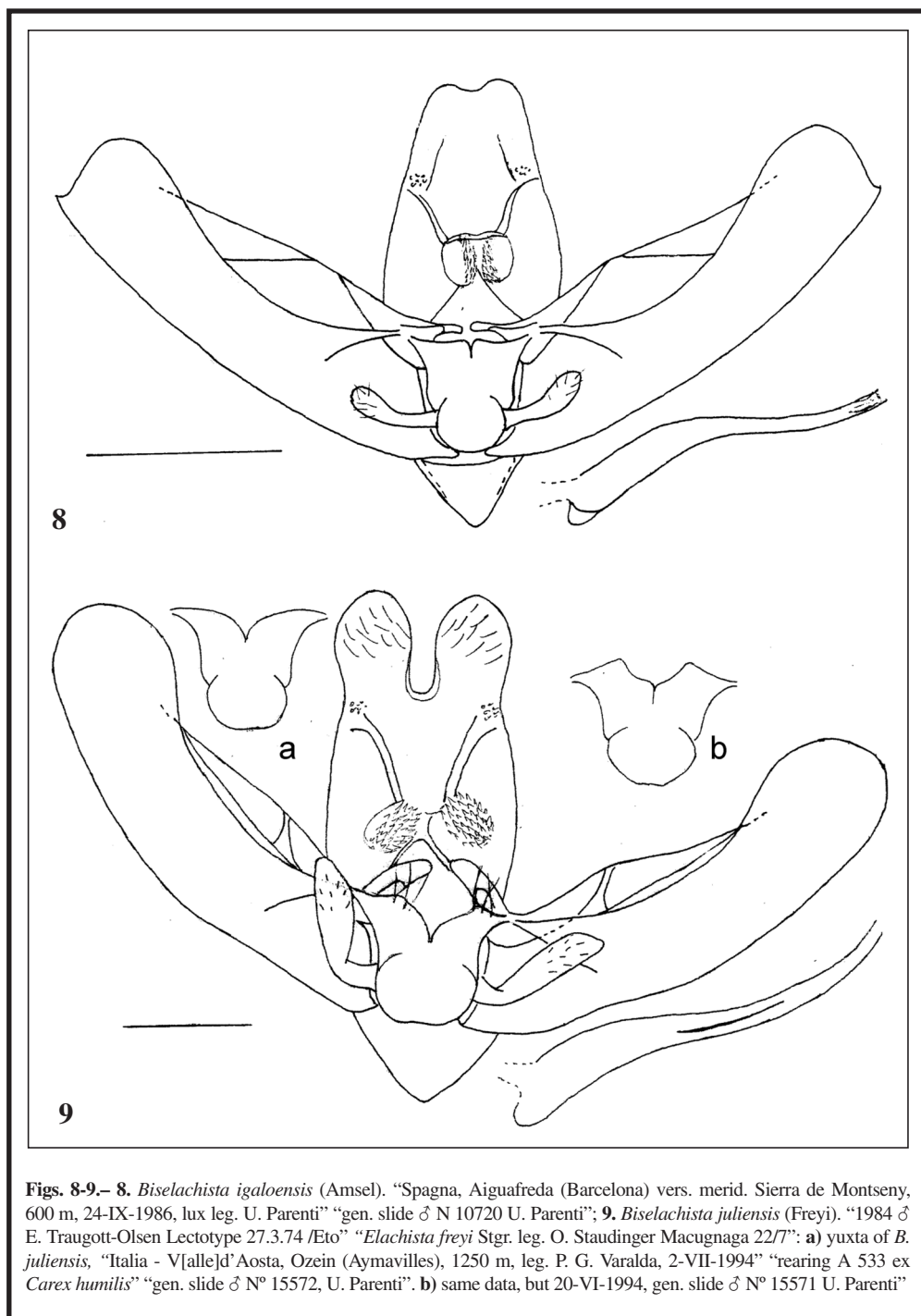


Figs. 2-3.— **2.** *Biselachista albidella* (Nylander). “*Eriophorum vaginatum*” “Austria sup.Tanner Moor, Liebeau. 12-VII-1979 Klimesch” “gen. slide ♂ N° 14775 U. Parenti” (Scale 0.2 mm); **3.** *Biselachista brachypterella* Klimesch. “Teriol mer., Sexten Kreuzbg. P., 1600 m, 15-VII-1990 J. Klimesch” “gen. slide ♂ N 14745 U. Parenti”.

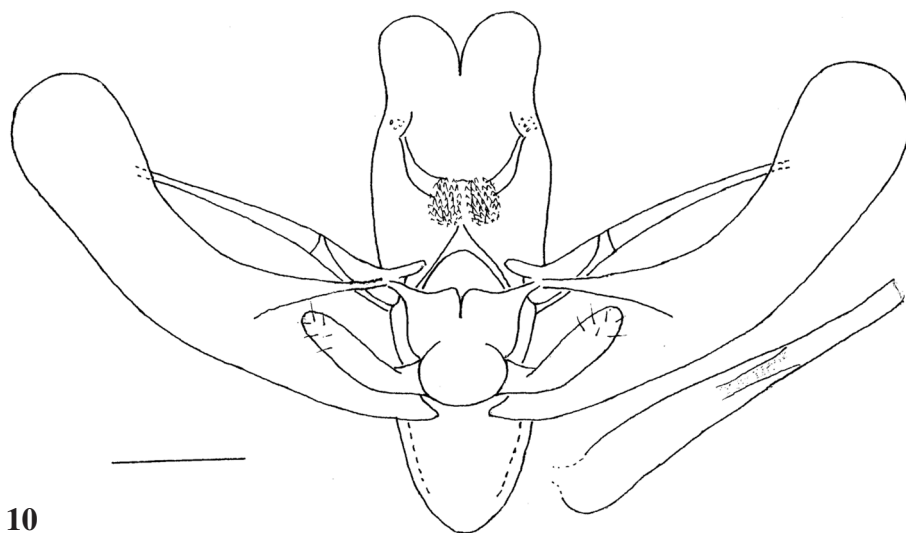


Figs. 4-5.– **4.** *Biselachista cinereopunctella* (Haworth). “Italia - Valle d’Aosta, Ozein Aymavilles (Aosta) 1330 m, 31-V-1995, e.l. *Carex humilis* leg. P.G. Varalda” “gen. slide ♂ N 14575 U. Parenti”; **5.** *Biselachista contaminatella* (Zeller). “Yu - Croazia - Krk Saline, 15-VIII-1976, leg. Baldizzone” “gen. slide ♂ N 3737 U. Parenti”.

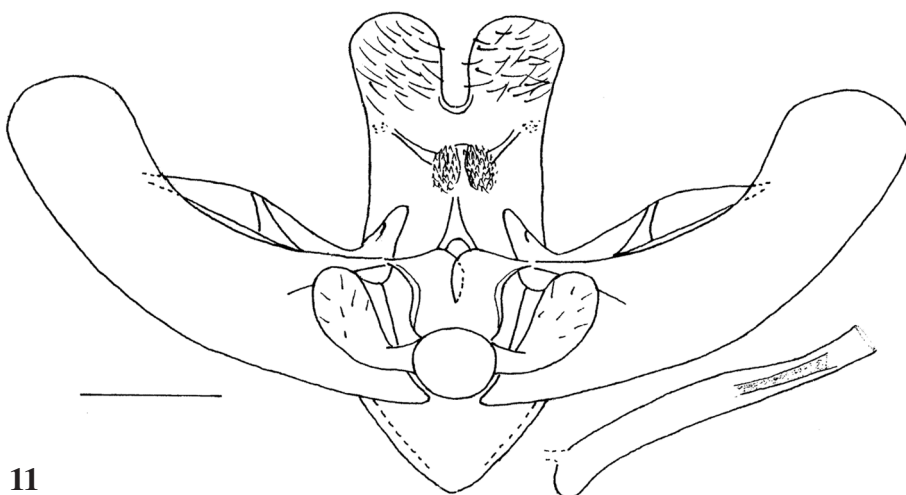




Figs. 8-9.– **8.** *Biselachista igaloensis* (Amsel). “Spagna, Aiguafreda (Barcelona) vers. merid. Sierra de Montseny, 600 m, 24-IX-1986, lux leg. U. Parenti” “gen. slide ♂ N 10720 U. Parenti”; **9.** *Biselachista juliensis* (Freyi). “1984 ♂ E. Traugott-Olsen Lectotype 27.3.74 /Eto” “*Elachista freyi* Stgr. leg. O. Staudinger Macugnaga 22/7”: **a)** juxta of *B. juliensis*, “Italia - V[alle]d’Aosta, Ozein (Aymavilles), 1250 m, leg. P. G. Varalda, 2-VII-1994” “rearing A 533 ex *Carex humilis*” “gen. slide ♂ N° 15572, U. Parenti”. **b)** same data, but 20-VI-1994, gen. slide ♂ N° 15571 U. Parenti”



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Figs. 10-11.– 10. *Biselachista kebneella* Traugott-Olsen & Nielsen. “Suecia To Abisko UTM 34W DA 1083, 2-VII-1992, Ingvar Svensson” “gen. slide ♂ N° 14755 U. Parenti”. 11. *Biselachista morandinii* (Huemer & Kaila). “I - Friuli V. Giulia Biotopo Torbiera di Curiedi UD[INE] (Tolmezzo), 870 m, 11-VII-2001, G. Governatori legit” “gen. slide ♂ N° 14388 U. Parenti”.

